FCC OET BULLETIN 65 SUPPLEMENT C
IC RSS-102 ISSUE 4

SAR EVALUATION REPORT

For

iPhone

MODEL: A1332

FCC ID: BCG-E2380A
IC: 579C-E2380A

REPORT NUMBER: 10U13135-2B

ISSUE DATE: June 3, 2010

Prepared for

APPLE INC
1 INFINITE LOOP, MS-26A
CUPERTINO, CA 95014

Prepared by

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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	April 15, 2010	Initial Issue	--
A	June 2, 2010	Updated average power table in section 9.5 WiFi RF output power.	Sunny Shih
B	June 3, 2010	Modify section 5 by including model variation statement between Model No:A1332 and A1332A.	Sunny Shih

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME:	APPLE INC 1 INFINITE LOOP, MS-26A CUPERTINO, CA 95014
EUT DESCRIPTION:	iPhone
MODEL NUMBER:	A1332
DEVICE CATEGORY:	Portable
EXPOSURE CATEGORY:	General Population/Uncontrolled Exposure
DATE TESTED:	March 29 – April 2, 2010

FCC / IC Rule Parts	Frequency Range [MHz]	Highest 1-g SAR (mW/g)	Limit (mW/g)
22H / RSS-132	824 - 849	Head: 1.00 (LHS Touch) Body: 1.11 (Face down)	1.6
24E / RSS-133	1850 - 1910	Head: 1.17 (RHS Touch) Body: 0.433 (Face down)	
15.247 / RSS-102	2400 – 2483.5	Head: 0.871 (LHS Tilt) Body: 0.073 (Face down)	

Applicable Standards	Test Results
FCC OET Bulletin 65 Supplement C 01-01 IC RSS 102 Issue 4	Pass

Compliance Certification Services, Inc. (CCS) tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by CCS based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by CCS will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government (NIST Handbook 150, Annex A). This report is written to support regulatory compliance of the applicable standards stated above.

Approved & Released For CCS By:

SUNNY SHIH
ENGINEERING SUPERVISOR
COMPLIANCE CERTIFICATION SERVICES

Tested By:

DEVIN CHANG
EMC ENGINEER
COMPLIANCE CERTIFICATION SERVICES

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC OET Bulletin 65 Supplement C 01-01, IC RSS 102 Issue 4 and the following specific FCC Test Procedures.

- o KDB 941225 D01 SAR test for 3G devices v02
- o KDB 941225 D03 SAR Test Reduction GSM/GPRS/EDGE vo1
- o KDB 648474 D01 SAR Handsets Multi Xmiter and Ant, v01r05
- o KDB 248227 D01 SAR meas for 802 11abg v01r02

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 Benicia Street, Fremont, California, USA.

CCS is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at http://www.ccsemc.com.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due date		
				MM	DD	Year
Robot - Six Axes	Stäubli	RX90BL	N/A	N/A		
Robot Remote Control	Stäubli	CS7MB	3403-91535	N/A		
DASY4 Measurement Server	SPEAG	SEUMS001BA	1041	N/A		
Probe Alignment Unit	SPEAG	LB (V2)	261	N/A		
SAM Phantom (SAM1)	SPEAG	QD000P40CA	1185	N/A		
SAM Phantom (SAM2)	SPEAG	QD000P40CA	1050	N/A		
Oval Flat Phantom (ELI 4.0)	SPEAG	QD OVA001 B	1003	N/A		
Electronic Probe kit	HP	85070C	N/A	N/A		
S-Parameter Network Analyzer	Agilent	8753ES-6	MY40001647	11	22	2010
Signal Generator	Agilent	8753ES-6	MY40001647	11	22	2010
E-Field Probe	SPEAG	EX3DV4	3531	2	22	2011
Thermometer	ERTCO	639-1S	1718	5	1	2010
Data Acquisition Electronics	SPEAG	DAE3 V1	500	9	15	2010
System Validation Dipole	SPEAG	D835V2	4d002	4	22	2011
System Validation Dipole	SPEAG	D900V2	108	11	23	2011
System Validation Dipole	SPEAG	D1800V2	294	11	24	2011
System Validation Dipole	SPEAG	D1900V2	5d043	11	23	2011
System Validation Dipole	SPEAG	D2450V2	748	4	13	2011
System Validation Dipole	SPEAG	D5GHzV2	1075	9	3	2011
Amplifier	Mini-Circuits	ZVE-8G	90606	N/A		
Amplifier	Mini-Circuits	ZHL-42W	D072701-5	N/A		
Simulating Liquid	CCS	H1900	N/A	Within 24 hrs of first test		
Simulating Liquid	CCS	M1900	N/A	Within 24 hrs of first test		
Simulating Liquid	CCS	H1800	N/A	Within 24 hrs of first test		
Simulating Liquid	CCS	M1800	N/A	Within 24 hrs of first test		
Simulating Liquid	CCS	H835	N/A	Within 24 hrs of first test		
Simulating Liquid	CCS	M835	N/A	Within 24 hrs of first test		
Simulating Liquid	CCS	H900	N/A	Within 24 hrs of first test		
Simulating Liquid	CCS	M900	N/A	Within 24 hrs of first test		
Simulating Liquid	SPEAG	H2450	N/A	Within 24 hrs of first test		
Simulating Liquid	SPEAG	M2450	N/A	Within 24 hrs of first test		

Note: Per KDB 450824 D02 requirements for dipole calibration, CCS has adopted three years calibration intervals. On annual basis, each measurement dipole has been evaluated and is in compliance with the following criteria:

1. There is no physical damage on the dipole
2. System validation with specific dipole is within 10% of calibrated value.
3. Return-loss is within 20% of calibrated measurement (test data on file in CCS)
4. Impedance is within 5Ω of calibrated measurement (test data on file in CCS)

4.2. MEASUREMENT UNCERTAINTY

Measurement uncertainty for 300 MHz to 3 GHz averaged over 1 gram

Component	error, %	Probe Distribution	Divisor	Sensitivity	U (Xi), %
Measurement System					
Probe Calibration (k=1) @ 835, 1900 and 2450 MHz	5.50	Normal	1	1	5.50
Axial Isotropy	1.15	Rectangular	1.732	0.7071	0.47
Hemispherical Isotropy	9.20	Rectangular	1.732	0.7071	3.76
Boundary Effect	0.90	Rectangular	1.732	1	0.52
Probe Linearity	3.45	Rectangular	1.732	1	1.99
System Detection Limits	1.00	Rectangular	1.732	1	0.58
Readout Electronics	0.30	Normal	1	1	0.30
Response Time	0.80	Rectangular	1.732	1	0.46
Integration Time	2.60	Rectangular	1.732	1	1.50
RF Ambient Conditions - Noise	3.00	Rectangular	1.732	1	1.73
RF Ambient Conditions - Reflections	3.00	Rectangular	1.732	1	1.73
Probe Positioner Mechanical Tolerance	0.40	Rectangular	1.732	1	0.23
Probe Positioning with respect to Phantom	2.90	Rectangular	1.732	1	1.67
Extrapolation, Interpolation and Integration	1.00	Rectangular	1.732	1	0.58
Test Sample Related					
Test Sample Positioning	2.90	Normal	1	1	2.90
Device Holder Uncertainty	3.60	Normal	1	1	3.60
Output Power Variation - SAR Drift	5.00	Rectangular	1.732	1	2.89
Phantom and Tissue Parameters					
Phantom Uncertainty (shape and thickness)	4.00	Rectangular	1.732	1	2.31
Liquid Conductivity - deviation from target	5.00	Rectangular	1.732	0.64	1.85
Liquid Conductivity - measurement @ head 835 MHz	4.94	Normal	1	0.64	3.16
Liquid Permittivity - deviation from target	5.00	Rectangular	1.732	0.6	1.73
Liquid Permittivity - measurement @ body 835 MHz	2.53	Normal	1	0.6	1.52
				Combined Standard Uncertainty Uc(y) =	10.71
				Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence = 21.41	%
				Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence = 1.69	dB

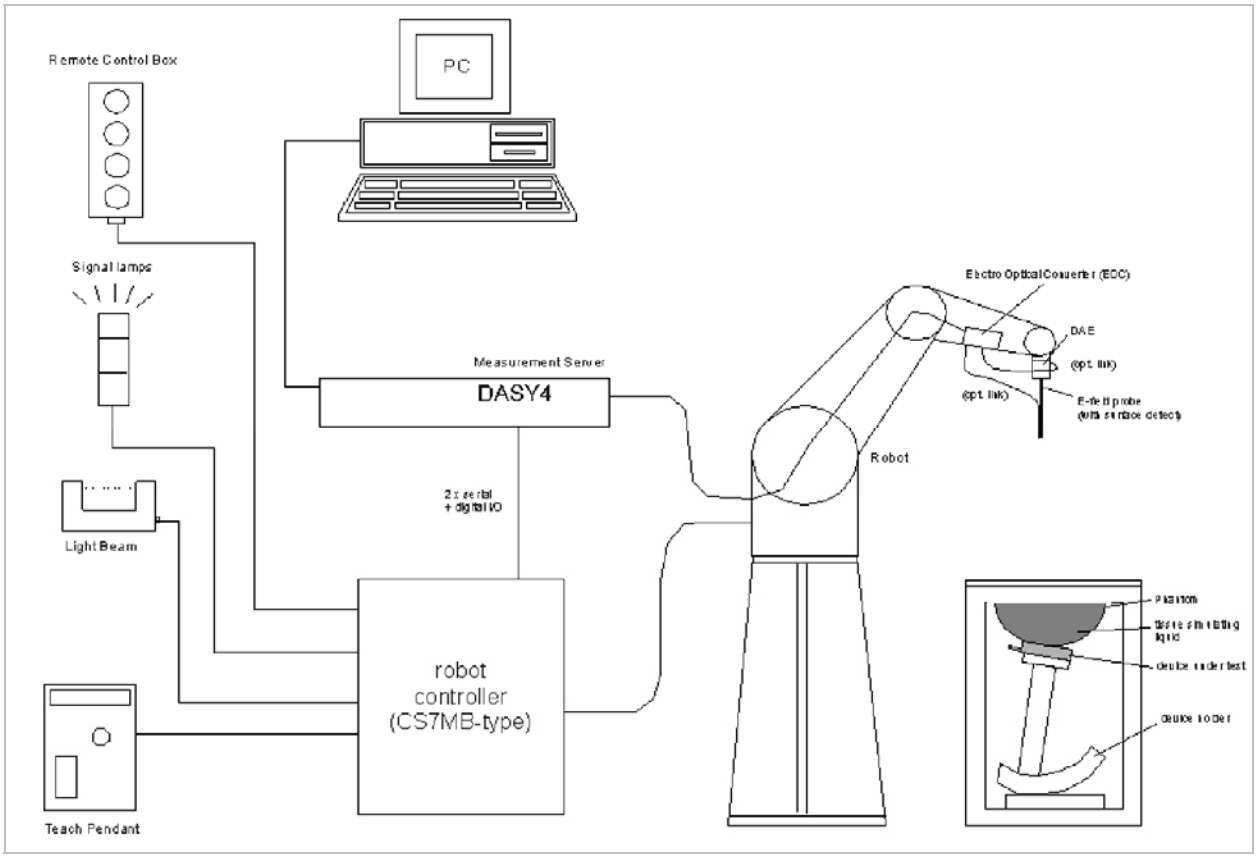
Measurement uncertainty for 300 MHz to 3 GHz averaged over 10 gram

Component	error, %	Probe Distribution	Divisor	Sensitivity	U (Xi), %
Measurement System					
Probe Calibration (k=1) @ 2450 MHz	5.50	Normal	1	1	5.50
Axial Isotropy	1.15	Rectangular	1.732	0.7071	0.47
Hemispherical Isotropy	9.20	Rectangular	1.732	0.7071	3.76
Boundary Effect	0.90	Rectangular	1.732	1	0.52
Probe Linearity	3.45	Rectangular	1.732	1	1.99
System Detection Limits	1.00	Rectangular	1.732	1	0.58
Readout Electronics	0.30	Normal	1	1	0.30
Response Time	0.80	Rectangular	1.732	1	0.46
Integration Time	2.60	Rectangular	1.732	1	1.50
RF Ambient Conditions - Noise	3.00	Rectangular	1.732	1	1.73
RF Ambient Conditions - Reflections	3.00	Rectangular	1.732	1	1.73
Probe Positioner Mechanical Tolerance	0.40	Rectangular	1.732	1	0.23
Probe Positioning with respect to Phantom	2.90	Rectangular	1.732	1	1.67
Extrapolation, Interpolation and Integration	1.00	Rectangular	1.732	1	0.58
Test Sample Related					
Test Sample Positioning	2.90	Normal	1	1	2.90
Device Holder Uncertainty	3.60	Normal	1	1	3.60
Output Power Variation - SAR Drift	5.00	Rectangular	1.732	1	2.89
Phantom and Tissue Parameters					
Phantom Uncertainty (shape and thickness)	4.00	Rectangular	1.732	1	2.31
Liquid Conductivity - deviation from target	5.00	Rectangular	1.732	0.43	1.24
Liquid Conductivity - measurement @ head 835 MHz	4.94	Normal	1	0.43	2.12
Liquid Permittivity - deviation from target	5.00	Rectangular	1.732	0.49	1.41
Liquid Permittivity - measurement @ body 835 MHz	2.53	Normal	1	0.49	1.24
				Combined Standard Uncertainty Uc(y), % =	10.27
				Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence = 20.54	%
				Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence = 1.62	dB

5. EQUIPMENT UNDER TEST

iPhone with 802.11bgn and Bluetooth radio modules.	
Mobile phone capability:	Class B
GPRS Multi-slot class:	Class 10
Normal operation:	Held to head, Worn on body (LCD facing-up; LCD facing-down) with 15 mm separation distance
Body Worn Accessory	Headset
Antenna tested:	Antenna — Apple part number 3G — 817-0286 WiFi/BT — 817-0286 (shared with BT)
Antenna-to-antenna separation distances:	8.7 cm from 3G main antenna-to-WiFi/BT main antenna
Simultaneous transmission:	- 3G can transmit simultaneously with WiFi - 3G can transmit simultaneously with Bluetooth - WiFi can not transmit simultaneously with Bluetooth
Model Variation	Model No: A1332 (FCC ID: BCG-E2380A/IC: 579C-E2380A) is equipped with WLAN module manufactured by Murata. Model No: A1332B (FCC ID: BCG-E2380B/IC: 579C-E2380B) is equipped with WLAN module manufactured by USI. 3G (Cellular /PCS band) SAR evaluations were made on Model No: A1332. Due to 3G portion of radio including antenna location are identical between Model No: A1332 and A1332B, 3G SAR portion of evaluations were leveraged in Model No: A1332B (FCC ID: BCG-E2380B/IC: 579C-E2380B). However, WLAN portion of SAR evaluations were individually tested in Model No:A1332 and A1332B.

6. SYSTEM SPECIFICATIONS



The DASY4 system for performing compliance tests consists of the following items:

- A standard high precision 6-axis robot (Stäubli RX family) with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- A dosimetric probe, i.e., an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- A probe alignment unit which improves the (absolute) accuracy of the probe positioning.
- A computer operating Windows 2000 or Windows XP.
- DASY4 software.
- Remote controls with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
- The SAM twin phantom enabling testing left-hand and right-hand usage.
- The device holder for handheld mobile phones.
- Tissue simulating liquid mixed according to the given recipes.
- Validation dipole kits allowing validating the proper functioning of the system.

7. LIQUID PARAMETERS CHECK

The simulating liquids should be checked at the beginning of a series of SAR measurements to determine of the dielectric parameters are within the tolerances of the specified target values. For frequencies in 300 MHz to just under 2 GHz, the measured conductivity and relative permittivity should be within ± 5% of the target values. For frequencies in the range of 2–3 GHz and above the measured conductivity should be within ± 5% of the target values. The measured relative permittivity tolerance can be relaxed to no more than ± 10%.

Reference Values of Tissue Dielectric Parameters for Head and Body Phantom

The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 in IEEE Standard 1528 have been incorporated in the following table. These head parameters are derived from planar layer models simulating the highest expected SAR for the dielectric properties and tissue thickness variations in a human head. Other head and body tissue parameters that have not been specified in P1528 are derived from the tissue dielectric parameters computed from the 4-Cole-Cole equations and extrapolated according to the head parameters specified in IEEE Standard 1528.

Target Frequency (MHz)	Head		Body	
	ε_r	σ (S/m)	ε_r	σ (S/m)
150	52.3	0.76	61.9	0.8
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.9	55.2	0.97
900	41.5	0.97	55	1.05
915	41.5	0.98	55	1.06
1450	40.5	1.2	54	1.3
1610	40.3	1.29	53.8	1.4
1800 – 2000	40	1.4	53.3	1.52
2450	39.2	1.8	52.7	1.95
3000	38.5	2.4	52	2.73
5800	35.3	5.27	48.2	6

(ε_r = relative permittivity, σ = conductivity and ρ = 1000 kg/m^3)

7.1. LIQUID CHECK RESULTS FOR 835 MHZ

Simulating Liquid Dielectric Parameters for Head 835 MHz
Room Ambient Temperature = 25°C; Relative humidity = 40% Measured by: Devin Chang

f (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit (%)
835	e'	43.55	Relative Permittivity (ϵ_r):	43.551	41.5	**4.94**	± 5
	e"	19.00	Conductivity (σ):	0.882	0.90	-1.96	± 5
900	e'	42.81	Relative Permittivity (ϵ_r):	42.814	41.5	3.17	± 5
	e"	18.99	Conductivity (σ):	0.951	0.97	-1.97	± 5

Liquid Check
Ambient temperature: 25 deg. C; Liquid temperature: 24 deg. C
March 30, 2010 10:34 AM

Frequency	e'	e"
800000000.	44.0101	19.1991
805000000.	43.9755	19.1593
810000000.	43.9296	19.1204
815000000.	43.9077	19.0973
820000000.	43.8792	19.0563
825000000.	43.8130	19.0229
830000000.	43.7171	19.0150
835000000.	**43.5508**	**18.9953**
840000000.	43.5995	18.9698
845000000.	43.5113	18.9318
850000000.	43.4459	18.9256
855000000.	43.3972	18.9369
860000000.	43.3272	18.9333
865000000.	43.2623	18.9761
870000000.	43.1686	18.9673
875000000.	43.0999	18.9762
880000000.	43.0545	18.9991
885000000.	42.9743	19.0214
890000000.	42.8872	19.0155
895000000.	42.8529	19.0105
900000000.	**42.8136**	**18.9922**
905000000.	42.7602	18.9843
910000000.	42.7316	18.9424
915000000.	42.7330	18.8796
920000000.	42.6731	18.8604
925000000.	42.6552	18.8301
930000000.	42.6288	18.7964
935000000.	42.6050	18.7924
940000000.	42.5321	18.7958

The conductivity (σ) can be given as:

$$\sigma = \omega \varepsilon_0 e'' = 2 \pi f \varepsilon_0 e''$$

where f = target f * 10^6

$\varepsilon_0 = 8.854 * 10^{-12}$

Simulating Liquid Dielectric Parameters for Body 835 MHz
Room Ambient Temperature = 24°C; Relative humidity = 40% Measured by: Devin Chang

f (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit (%)
835	e'	55.12	Relative Permittivity (ϵ_r):	55.115	55.2	-0.15	± 5
	e"	21.41	Conductivity (σ):	0.995	0.97	**2.53**	± 5
900	e'	55.50	Relative Permittivity (ϵ_r):	55.497	55.0	0.90	± 5
	e"	21.42	Conductivity (σ):	1.073	1.05	2.15	± 5

Liquid Check
Ambient temperature: 24 deg. C; Liquid temperature: 23 deg. C
March 30, 2010 10:37 PM

Frequency	e'	e"
800000000.	55.5302	21.8371
805000000.	55.4445	21.7861
810000000.	55.3672	21.7135
815000000.	55.3059	21.6517
820000000.	55.2709	21.5861
825000000.	55.2133	21.5104
830000000.	55.1378	21.4586
835000000.	**55.1151**	**21.4109**
840000000.	55.0835	21.3863
845000000.	55.0393	21.3777
850000000.	54.9779	21.3922
855000000.	54.9279	21.3918
860000000.	54.9175	21.3965
865000000.	54.8534	21.4132
870000000.	54.8310	21.4467
875000000.	54.7927	21.4801
880000000.	54.7526	21.4840
885000000.	54.6919	21.4954
890000000.	54.6069	21.4686
895000000.	54.5616	21.4634
900000000.	**54.4969**	**21.4221**
905000000.	54.4574	21.3325
910000000.	54.4488	21.2731
915000000.	54.4015	21.1980
920000000.	54.3946	21.0957
925000000.	54.4223	21.0374
930000000.	54.4049	21.0100
935000000.	54.3445	20.9873
940000000.	54.3251	20.9743
945000000.	54.2904	21.0045
950000000.	54.1988	21.0355

The conductivity (σ) can be given as:

$$\sigma = \omega \varepsilon_0 e'' = 2 \pi f \varepsilon_0 e''$$

where f = target f * 10^6

$\varepsilon_0 = 8.854 * 10^{-12}$

7.2. LIQUID CHECK RESULTS FOR 1900 MHZ

Simulating Liquid Dielectric Parameters for Head 1900 MHz
Room Ambient Temperature = 25°C; Relative humidity = 35% Measured by: Devin Chang

f (MHz)	Liquid Parameters		Measured Results		Target	Delta (%)	Limit (%)
1900	e'	39.091	Relative Permittivity (ϵ_r):	39.0913	40.0	-2.27	± 5
	e"	12.830	Conductivity (σ):	1.35617	1.40	-3.13	± 5

Liquid Check
Ambient temperature: 25 deg. C; Liquid temperature: 24 deg. C
March 29, 2010 09:49 AM

Frequency	e'	e"
1710000000.	39.8598	12.2955
1720000000.	39.8352	12.2904
1730000000.	39.8012	12.3049
1740000000.	39.7248	12.3515
1750000000.	39.6682	12.3868
1760000000.	39.6157	12.4247
1770000000.	39.5756	12.4745
1780000000.	39.5571	12.5246
1790000000.	39.5194	12.5759
1800000000.	39.5058	12.5752
1810000000.	39.4805	12.5965
1820000000.	39.4655	12.6033
1830000000.	39.4151	12.5821
1840000000.	39.3641	12.6008
1850000000.	39.3205	12.6437
1860000000.	39.2725	12.6829
1870000000.	39.2238	12.7401
1880000000.	39.1721	12.7922
1890000000.	39.1167	12.8239
1900000000.	**39.0913**	**12.8304**
1910000000.	39.0792	12.7804

The conductivity (σ) can be given as:

$$\sigma = \omega \varepsilon_0 e'' = 2 \pi f \varepsilon_0 e''$$

where f = target f * 10^6

$\varepsilon_0 = 8.854 * 10^{-12}$

Simulating Liquid Dielectric Parameters for Body 1900 MHz
Room Ambient Temperature = 25°C; Relative humidity = 40% Measured by: Devin Chang

f (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit (%)
1900	e'	53.321	Relative Permittivity (ϵ_r):	53.3210	53.3	0.04	± 5
	e"	14.181	Conductivity (σ):	1.49890	1.52	-1.39	± 5

Liquid Check
Ambient temperature: 25 deg. C; Liquid temperature: 24 deg. C
March 29, 2010 04:00 PM

Frequency	e'	e"
1710000000.	53.7503	13.7620
1720000000.	53.7109	13.8322
1730000000.	53.6955	13.8796
1740000000.	53.6407	13.9186
1750000000.	53.6403	13.8852
1760000000.	53.6668	13.8236
1770000000.	53.7017	13.7981
1780000000.	53.6989	13.8092
1790000000.	53.6625	13.8566
1800000000.	53.5996	13.9029
1810000000.	53.5292	13.9979
1820000000.	53.4297	14.0844
1830000000.	53.3250	14.1565
1840000000.	53.2381	14.1691
1850000000.	53.2505	14.1402
1860000000.	53.3423	14.1166
1870000000.	53.4158	14.1363
1880000000.	53.4418	14.1658
1890000000.	53.3862	14.1963
1900000000.	**53.3210**	**14.1808**
1910000000.	53.2479	14.1506

The conductivity (σ) can be given as:

$$\sigma = \omega \varepsilon_0 e'' = 2 \pi f \varepsilon_0 e''$$

where f = target f * 10^6

$\varepsilon_0 = 8.854 * 10^{-12}$

7.3. LIQUID CHECK RESULTS FOR 2450 MHZ

Simulating Liquid Dielectric Parameters for Head 2450 MHz
Room Ambient Temperature = 25°C; Relative humidity = 40% Measured by: Devin Chang

f (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit (%)
2450	e'	39.76	Relative Permittivity (ε_r):	39.756	39.2	1.42	± 5
	e"	13.19	Conductivity (σ):	1.797	1.80	-0.16	± 5

Liquid Check
Ambient temperature: 25 deg. C; Liquid temperature: 24 deg. C
April 02, 2010 02:06 PM

Frequency	e'	e"
2400000000.	39.8777	12.9447
2405000000.	39.8551	12.9906
2410000000.	39.8216	13.0484
2415000000.	39.7894	13.0711
2420000000.	39.7613	13.1008
2425000000.	39.7529	13.1068
2430000000.	39.7500	13.1210
2435000000.	39.7506	13.1242
2440000000.	39.7499	13.1417
2445000000.	39.7560	13.1684
2450000000.	**39.7556**	**13.1858**
2455000000.	39.7195	13.2037
2460000000.	39.6928	13.1839
2465000000.	39.6497	13.1566
2470000000.	39.6364	13.1373
2475000000.	39.6130	13.1108
2480000000.	39.6116	13.0997
2485000000.	39.6152	13.0879
2490000000.	39.6265	13.1117
2495000000.	39.6104	13.1621
2500000000.	39.5867	13.2111

The conductivity (σ) can be given as:

$$\sigma = \omega \varepsilon_0 e'' = 2 \pi f \varepsilon_0 e''$$

where f = target f * 10^6

$\varepsilon_0 = 8.854 * 10^{-12}$

Simulating Liquid Dielectric Parameters for Body 2450 MHz
Room Ambient Temperature = 25°C; Relative humidity = 40% Measured by: Devin Chang

f (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit (%)
2450	e'	52.90	Relative Permittivity (ϵ_r):	52.901	52.7	0.38	± 5
	e"	14.30	Conductivity (σ):	1.949	1.95	-0.03	± 5

Liquid Check
Ambient temperature: 25 deg. C; Liquid temperature: 24 deg. C
April 02, 2010 02:01 PM

Frequency	e'	e"
2400000000.	53.0014	14.0434
2405000000.	52.9818	14.1003
2410000000.	52.9627	14.1618
2415000000.	52.9226	14.1641
2420000000.	52.9110	14.1984
2425000000.	52.9009	14.2126
2430000000.	52.8963	14.2197
2435000000.	52.8955	14.2349
2440000000.	52.9158	14.2379
2445000000.	52.9057	14.2830
2450000000.	**52.9013**	**14.3027**
2455000000.	52.8668	14.3193
2460000000.	52.8630	14.2934
2465000000.	52.8189	14.2786
2470000000.	52.8047	14.2572
2475000000.	52.7793	14.2360
2480000000.	52.7867	14.2296
2485000000.	52.7952	14.2438
2490000000.	52.7963	14.2774
2495000000.	52.7908	14.3285
2500000000.	52.7693	14.4046

The conductivity (σ) can be given as:

$$\sigma = \omega \varepsilon_0 e'' = 2 \pi f \varepsilon_0 e''$$

where f = target f * 10^6

ε_0 = 8.854 * 10^{-12}

8. SYSTEM VERIFICATION

The system performance check is performed prior to any usage of the system in order to verify SAR system measurement accuracy. The system performance check verifies that the system operates within its specifications of ±10%.

System Performance Check Measurement Conditions

- The measurements were performed in the flat section of the SAM twin phantom filled with Head or Body simulating liquid of the following parameters.
- The DASY4 system with an Isotropic E-Field Probe EX3DV3 was used for the measurements.
- The dipole was mounted on the small tripod so that the dipole feed point was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 10 mm (above 1 GHz) and 15 mm (below 1 GHz) from dipole center to the simulating liquid surface.
- The coarse grid with a grid spacing of 15 mm was aligned with the dipole.
  For 5 GHz band - The coarse grid with a grid spacing of 10 mm was aligned with the dipole.
- Special 7x7x7 fine cube was chosen for cube
- Distance between probe sensors and phantom surface was set to 3 mm.
  For 5 GHz band - Distance between probe sensors and phantom surface was set to 2.5 mm
- The dipole input power (forward power) was 100 mW
- The results are normalized to 1 W input power.

Reference SAR Values for HEAD & BODY-tissue from calibration certificate of SPEAG.

System validation dipole	Cal. certificate #	Cal. due date	SAR Avg (mW/g)		
			Tissue:	Head	Body
D835V2	D835V2-5d043_Nov09	Nov-12	SAR_{1g}:	9.64	9.96
			SAR_{10g}:	6.28	6.56
D1900V2	D1900V2-4d002_Apr09	Apr-12	SAR_{1g}:	39.8	40.4
			SAR_{10g}:	20.7	21.4
D2450V2	D2450V2-748_Apr08	Apr-11	SAR_{1g}:		50.8
			SAR_{10g}:		23.7

8.1. SYSTEM CHECK RESULTS FOR D835V2

Ambient Temperature = 25°C; Relative humidity = 40% Measured by: Devin Chang

System validation dipole	Date Tested	Measured (Normalized to 1 W)		Target	Delta (%)	Tolerance (%)
		Tissue:	Head			
D835V2	03/30/10	SAR_{1g}:	9.12	9.64	-5.39	±10
		SAR_{10g}:	5.98	6.28	-4.78	

8.2. SYSTEM CHECK RESULTS FOR D1900V2

Ambient Temperature = 25°C; Relative humidity = 37% Measured by: Devin Chang

System validation dipole	Date Tested	Measured (Normalized to 1 W)		Target	Delta (%)	Tolerance (%)
		Tissue:	Head			
D1900V2	03/29/10	SAR_{1g}:	38.0	39.8	-4.52	±10
		SAR_{10g}:	19.1	20.7	-7.73	

8.3. SYSTEM CHECK RESULTS FOR D2450V2

Ambient Temperature = 24°C; Relative humidity = 40% Measured by: Devin Chang

System validation dipole	Date Tested	Measured (Normalized to 1 W)		Target	Delta (%)	Tolerance (%)
		Tissue:	Body			
D2450V2	04/02/10	SAR_{1g}:	51.8	50.8	1.97	±10
		SAR_{10g}:	24.1	23.7	1.69	

9. OUTPUT POWER VERIFICATION

9.1. GSM

GSM (GMSK)

Band	Ch No.	f (MHz)	Avg burst Pwr (dBm)
GSM850	128	824.2	32.4
	190	836.6	32.5
	251	848.8	32.5
GSM1900	512	1850.2	30.4
	661	1880	30.3
	810	1909.8	30.4

GPRS (GMSK) - Coding Scheme: CS1

Band	Ch No.	f (MHz)	Avg burst Pwr (dBm)			
			1 slot	Frame Avg Pwr	2 slot	Frame Avg Pwr
GSM850	128	824.2	32.50	23.50	31.50	25.50
	190	836.6	32.40	23.40	31.50	25.50
	251	848.8	32.50	23.50	31.50	25.50
GSM1900	512	1850.2	30.40	21.40	28.60	22.60
	661	1880	30.40	21.40	28.70	22.70
	810	1909.8	30.30	21.30	28.70	22.70

EGPRS (8PSK) - Coding Scheme: MCS5

Band	Ch No.	f (MHz)	Avg burst Pwr (dBm)			
			1 slot	Frame Avg Pwr	2 slot	Frame Avg Pwr
GSM850	128	824.2	27.00	18.00	27.10	21.10
	190	836.6	27.00	18.00	27.00	21.00
	251	848.8	27.00	18.00	27.10	21.10
GSM1900	512	1850.2	26.10	20.10	26.10	20.10
	661	1880	26.10	20.10	26.10	20.10
	810	1909.8	26.10	20.10	26.10	20.10

9.2. UMTS RELEASE 99

The following tests were completed according to the test requirements outlined in section 5.2 of the 3GPP TS34.121-1 specification. The EUT supports power Class 3, which has a nominal maximum output power of 24 dBm (+1.7/-3.7).

	Mode	Rel99
	Subtest	-
WCDMA General Settings	Loopback Mode	Test Mode 1
	Rel99 RMC	12.2kbps RMC
	Power Control Algorithm	Algorithm2
	βc/βd	8/15

Results

Rel 99 (12.2kps RMC)

Band	Mode	UL Ch No.	DL Ch No.	f (MHz)	Avg Tx Pwr (dBm)
UMTS850 (Band V)	Rel 99 12.2kbps RMC	4132	4357	826.4	23.69
		4183	4408	836.6	23.43
		4233	4458	846.6	23.61
UMTS1900 (Band II)	Rel 99 12.2kbps RMC	9262	9662	1852.4	22.85
		9400	9800	1880.0	22.86
		9538	9938	1907.6	22.81

9.3. UMTS HSDPA

The following 4 Sub-tests were completed according to Release 6 procedures in section 5.2 of 3GPP TS34.121. A summary of these settings are illustrated below:

	Mode	Rel6 HSDPA	Rel6 HSDPA	Rel6 HSDPA	Rel6 HSDPA
	Subtest	1	2	3	4
WCDMA General Settings	Loopback Mode	Test Mode 1			
	Rel99 RMC	12.2kbps RMC			
	HSDPA FRC	H-Set1			
	Power Control Algorithm	Algorithm 2			
	βc	2/15	12/15	15/15	15/15
	βd	15/15	15/15	8/15	4/15
	Bd (SF)	64			
	βc/βd	2/15	12/15	15/8	15/4
	βhs	4/15	24/15	30/15	30/15
	CM (dB)	0	1	1.5	1.5
HSDPA Specific Settings	D_{ACK}	8			
	D_{NAK}	8			
	DCQI	8			
	Ack-Nack repetition factor	3			
	CQI Feedback (Table 5.2B.4)	4ms			
	CQI Repetition Factor (Table 5.2B.4)	2			
	Ahs =βhs/βc	30/15			

Results

Rel 6 HSDPA

Band	Mode	UL Ch No.	DL Ch No.	f (MHz)	Avg Tx Pwr (dBm)
UMTS850 (Band V)	Subtest 1	4132	4357	826.4	23.65
		4183	4408	836.6	23.42
		4233	4458	846.6	23.60
	Subtest 2	4132	4357	826.4	22.69
		4183	4408	836.6	22.43
		4233	4458	846.6	22.61
	Subtest 3	4132	4357	826.4	22.29
		4183	4408	836.0	22.13
		4233	4458	846.6	22.21
	Subtest 4	4132	4357	826.4	22.19
		4183	4408	836.4	22.03
		4233	4458	846.6	22.11
UMTS1900 (Band II)	Subtest 1	9262	9662	1852.4	22.84
		9400	9800	1880.0	22.83
		9538	9938	1907.6	22.81
	Subtest 2	9262	9662	1852.4	21.85
		9400	9800	1880.0	21.85
		9538	9938	1907.6	21.81
	Subtest 3	9262	9662	1852.4	21.45
		9400	9800	1880.0	21.55
		9538	9938	1907.6	21.41
	Subtest 4	9262	9662	1852.4	21.55
		9400	9800	1880.0	21.45
		9538	9938	1907.6	21.51

Note: KDB 941225 D01 – Body SAR is not required for HSDPA when the maximum average output of each RF channel with HSDPA active is less than ¼ dB higher than that measured without HSDPA using 12.2 kbps RMC or the maximum SAR for 12.2 kbps RMC is < 75% of the SAR limit.

9.4. UMTS Rel 6 HSPA (HSDPA & HSUPA)

The following 5 Sub-tests were completed according to Release 6 procedures in section 5.2 of 3GPP TS34.121. A summary of these settings are illustrated below:

	Mode	Rel6 HSPA	Rel6 HSPA	Rel6 HSPA	Rel6 HSPA	Rel6 HSPA
	Subtest	1	2	3	4	5
WCDMA General Settings	Loopback Mode	Test Mode 1				
	Rel99 RMC	12.2kbps RMC				
	HSDPA FRC	H-Set1				
	HSUPA Test	HSUPA Loopback				
	Power Control Algorithm	Algorithm2				
	βc	11/15	6/15	15/15	2/15	15/15
	βd	15/15	15/15	9/15	15/15	15/15
	βec	209/225	12/15	30/15	2/15	24/15
	βc/βd	11/15	6/15	15/9	2/15	15/15
	βhs	22/15	12/15	30/15	4/15	30/15
	βed	1309/225	94/75	47/15 47/15	56/75	134/15
	CM (dB)	1.0	3.0	2.0	3.0	1.0
	MPR (dB)	0	2	1	2	0
HSDPA Specific Settings	DACK	8				
	DNAK	8				
	DCQI	8				
	Ack-Nack repetition factor	3				
	CQI Feedback (Table 5.2B.4)	4ms				
	CQI Repetition Factor (Table 5.2B.4)	2				
	Ahs = βhs/βc	30/15				
HSUPA Specific Settings	D E-DPCCH	6	8	8	5	7
	DHARQ	0	0	0	0	0
	AG Index	20	12	15	17	21
	ETFCI (from 34.121 Table C.11.1.3)	75	67	92	71	81
	Associated Max UL Data Rate kbps	242.1	174.9	482.8	205.8	308.9
	Reference E_TFCIs	E-TFCI 11 E-TFCI PO 4 E-TFCI 67 E-TFCI PO 18 E-TFCI 71 E-TFCI PO 23 E-TFCI 75 E-TFCI PO 26 E-TFCI 81 E-TFCI PO 27		E-TFCI 11 E-TFCI PO 4 E-TFCI 92 E-TFCI PO 18	E-TFCI 11 E-TFCI PO 4 E-TFCI 67 E-TFCI PO 18 E-TFCI 71 E-TFCI PO 23 E-TFCI 75 E-TFCI PO 26 E-TFCI 81 E-TFCI PO 27	

Results

Rel 6 HSDPA/HSUPA

Band	Mode	UL Ch No.	DL Ch No.	f (MHz)	Avg Tx Pwr (dBm)
UMTS850 (Band V)	Subtest 1	4132	4357	826.4	23.66
		4182	4407	836.4	23.42
		4233	4458	846.6	23.62
	Subtest 2	4132	4357	826.4	21.96
		4182	4407	836.4	21.82
		4233	4458	846.6	21.92
	Subtest 3	4132	4357	826.4	22.76
		4182	4407	836.4	22.62
		4233	4458	846.6	22.72
	Subtest 4	4132	4357	826.4	21.86
		4182	4407	836.4	21.72
		4233	4458	846.6	21.77
	Subtest 5	4132	4357	826.4	23.61
		4182	4407	836.4	23.38
		4233	4458	846.6	23.58
UMTS1900 (Band II)	Subtest 1	9262	9662	1852.4	22.83
		9400	9800	1880.0	22.82
		9538	9938	1907.6	22.82
	Subtest 2	9262	9662	1852.4	21.13
		9400	9800	1880.0	21.12
		9538	9938	1907.6	21.02
	Subtest 3	9262	9662	1852.4	21.93
		9400	9800	1880.0	21.97
		9538	9938	1907.6	21.95
	Subtest 4	9262	9662	1852.4	21.03
		9400	9800	1880.0	21.05
		9538	9938	1907.6	21.04
	Subtest 5	9262	9662	1852.4	22.81
		9400	9800	1880.0	22.81
		9538	9938	1907.6	22.80

Note: KDB 941225 D01 – Body SAR is not required for handsets with HSPA capabilities when the maximum average output of each RF channel with HSUPA/HSDPA active is less than ¼ dB higher than that measured without HSUPA/HSDPA using 12.2 kbps RMC and the maximum SAR for 12.2kbps RMC is ≤ 75% of the SAR limit.

9.5. WIFI RF OUTPUT POWER

MURATA unit

802.11b

Channel #	Freq. (MHz)	Avg Power (dBm)
Low	2412	16.5
Middle	2437	16.6
High	2462	16.6
802.11g		
Low	2412	13.0
Middle	2437	16.5
High	2462	14.0
802.11n HT20		
Low	2412	13.0
Middle	2437	16.5
High	2462	14.1

Note: KDB 248227 - SAR is not required for 802.11g/HT20 channels when the maximum average output power is less than 1/4 dB higher than that measured on the corresponding 802.11b channels.

10. SUMMARY OF TEST RESULTS

10.1. GSM850

Left Hand Side

Band	Mode	Test position	Ch No.	Freq. (MHz)	SAR (mW/g)	
					1-g	10-g
GSM850	GSM	Touch	128	824.2	0.677	0.492
			190	836.6	0.860	0.626
			251	848.8	0.977	0.713
		Tilt (15°C)	128	824.2		
			190	836.6	0.300	0.232
			251	848.8		

Right Hand Side

Band	Mode	Test position	Ch No.	Freq. (MHz)	SAR (mW/g)	
					1-g	10-g
GSM850	GSM	Touch	128	824.2		
			190	836.6	0.656	0.457
			251	848.8		
		Tilt (15°C)	128	824.2		
			190	836.6	0.372	0.282
			251	848.8		

Body with 1.5 cm separation distance

Band	Mode	Test position	Ch No.	Freq. (MHz)	SAR (mW/g)	
					1-g	10-g
GSM850	GSM	Face up	190	836.6	0.760	0.559
		Face down	128	824.2	0.740	0.540
			190	836.6	0.824	0.603
			251	848.8	0.838	0.615
		w/ headset	251	848.8	0.586	0.407
	GPRS 1 slots	Face up	190	836.6	0.620	0.456
		Face down	190	836.6	0.635	0.464
	GPRS 2 slots	Face up	128	824.2	0.937	0.688
			190	836.6	0.994	0.732
			251	848.8	1.020	0.751
		Face down	128	824.2	0.953	0.693
			190	836.6	1.050	0.766
			251	848.8	**1.110**	0.809
		w/ headset	251	848.8	0.871	0.618
	EGPRS 1 slots	Face up	190	836.6	0.193	0.141
		Face down	190	836.6	0.198	0.143
	EGPRS 2 slots	Face up	190	836.6	0.378	0.280
		Face down	190	836.6	0.392	0.286
		w/ headset	190	836.6	0.229	0.161

10.2. GSM1900

Left Hand Side

Band	Mode	Test position	Ch No.	Freq. (MHz)	SAR (mW/g)	
					1-g	10-g
GSM1900	GSM	Touch	512	1850.2		
			661	1880.0	0.732	0.478
			810	1909.8		
		Tilt (15°C)	512	1850.2		
			661	1880.0	0.303	0.198
			810	1909.8		

Right Hand Side

Band	Mode	Test position	Ch No.	Freq. (MHz)	SAR (mW/g)	
					1-g	10-g
GSM1900	GSM	Touch	512	1850.2		
			661	1880.0	0.736	0.492
			810	1909.8		
		Tilt (15°C)	512	1850.2		
			661	1880.0	0.358	0.218
			810	1909.8		

Body with 1.5 cm separation distance

Band	Mode	Test position	Ch No.	Freq. (MHz)	SAR (mW/g)	
					1-g	10-g
GSM1900	GSM	Face up	661	1880.0	0.271	0.170
		w/ headset	661	1880.0	0.200	0.131
		Face down	661	1880.0	0.267	0.174
	GPRS 1 slots	Face up	661	1880.0	0.255	0.163
		Face down	661	1880.0	0.263	0.173
	GPRS 2 slots	Face up	661	1880.0	0.321	0.211
		Face down	661	1880.0	0.346	0.227
		w/ headset	661	1880.0	0.281	0.177
	EGPRS 1 slots	Face up	661	1880.0	0.090	0.060
		Face down	661	1880.0	0.096	0.063
	EGPRS 2 slots	Face up	661	1880.0	0.183	0.121
		Face down	661	1880.0	0.195	0.127
		w/ headset	661	1880.0	0.162	0.107

10.3. UMTS BAND V

Left Hand Side

Band	Mode	Test position	UL Ch No.	DL Ch No.	f (MHz)	SAR (mW/g)	
						1-g	10-g
Band V	R99 12.2kbps RMC	Touch	4132	4357	826.4	0.891	0.647
			4183	4408	836.6	**1.000**	0.729
			4233	4458	846.6	0.998	0.723
		Tilt (15°C)	4132	4357	826.4		
			4183	4408	836.6	0.433	0.332
			4233	4458	846.6		

Right Hand Side

Band	Mode	Test position	UL Ch No.	DL Ch No.	f (MHz)	SAR (mW/g)	
						1-g	10-g
Band V	R99 12.2kbps RMC	Touch	4132	4357	826.4	0.642	0.457
			4183	4408	836.6	0.833	0.587
			4233	4458	846.6	0.802	0.568
		Tilt (15°C)	4132	4357	826.4		
			4183	4408	836.6	0.450	0.341
			4233	4458	846.6		

Body with 1.5 cm separation distance

Band	Mode	Test position	UL Ch No.	DL Ch No.	f (MHz)	SAR (mW/g)	
						1-g	10-g
Band V	R99 12.2kbps RMC	Face up	4132	4357	826.4		
			4183	4408	836.6	0.728	0.536
			4233	4458	846.6		
		Face down	4132	4357	826.4		
			4183	4408	836.6	0.774	0.567
			4233	4458	846.6		
		w/ headset	4233	4458	846.6	0.540	0.385

Notes:

1) KDB 941225 D01 – Body SAR is not required for HSDPA when the maximum average output of each RF channel with HSDPA active is less than ¼ dB higher than that measured without HSDPA using 12.2 kbps RMC or the maximum SAR for 12.2 kbps RMC is < 75% of the SAR limit.
2) KDB 941225 D01 – Body SAR is not required for handsets with HSPA capabilities when the maximum average output of each RF channel with HSUPA/HSDPA active is less than ¼ dB higher than that measured without HSUPA/HSDPA using 12.2 kbps RMC and the maximum SAR for 12.2kbps RMC is ≤ 75% of the SAR limit.

10.4. UMTS BAND II

Left Hand Side

Band	Mode	Test position	UL Ch No.	DL Ch No.	f (MHz)	SAR (mW/g)	
						1-g	10-g
Band II	R99 12.2kbps RMC	Touch	9262	9662	1850.2	1.110	0.720
			9400	9800	1880.0	1.090	0.711
			9538	9938	1907.6	**1.170**	0.756
		Tilt (15°C)	9262	9662	1850.2		
			9400	9800	1880.0	0.411	0.261
			9538	9938	1907.6		

Right Hand Side

Band	Mode	Test position	UL Ch No.	DL Ch No.	f (MHz)	SAR (mW/g)	
						1-g	10-g
Band II	R99 12.2kbps RMC	Touch	9262	9662	1850.2	1.140	0.771
			9400	9800	1880.0	1.130	0.756
			9538	9938	1907.6	1.170	0.786
		Tilt (15°C)	9262	9662	1850.2		
			9400	9800	1880.0	0.549	0.335
			9538	9938	1907.6		

Body with 1.5 cm separation distance

Band	Mode	Test position	UL Ch No.	DL Ch No.	f (MHz)	SAR (mW/g)	
						1-g	10-g
Band II	R99 12.2kbps RMC	Face up	9262	9662	1850.2		
			9400	9800	1880.0	0.424	0.275
			9538	9938	1907.6		
		Face down	9262	9662	1850.2		
			9400	9800	1880.0	**0.433**	0.283
			9538	9938	1907.6		
		w/ headset	9400	9800	1880.0	0.331	0.219

Notes:

1) KDB 941225 D01 – Body SAR is not required for HSDPA when the maximum average output of each RF channel with HSDPA active is less than ¼ dB higher than that measured without HSDPA using 12.2 kbps RMC or the maximum SAR for 12.2 kbps RMC is < 75% of the SAR limit.
2) KDB 941225 D01 – Body SAR is not required for handsets with HSPA capabilities when the maximum average output of each RF channel with HSUPA/HSDPA active is less than ¼ dB higher than that measured without HSUPA/HSDPA using 12.2 kbps RMC and the maximum SAR for 12.2kbps RMC is ≤ 75% of the SAR limit.

10.5. WIFI

MURATA unit

Left Hand Side

Band	Mode	Test position	Ch No.	Freq. (MHz)	SAR (mW/g)	
					1-g	10-g
2.4 GHz	802.11b	Touch	1	2412		
			6	2437	0.651	0.296
			11	2462		
		Tilt (15°C)	1	2412	0.741	0.326
			6	2437	0.826	0.363
			11	2462	**0.871**	0.385

Right Hand Side

Band	Mode	Test position	Ch No.	Freq. (MHz)	SAR (mW/g)	
					1-g	10-g
2.4 GHz	802.11b	Touch	1	2412		
			6	2437	0.583	0.263
			11	2462		
		Tilt (15°C)	1	2412		
			6	2437	0.698	0.311
			11	2462		

Body with 1.5 cm separation distance

Band	Mode	Test position	Ch No.	Freq. (MHz)	SAR (mW/g)	
					1-g	10-g
2.4 GHz	802.11b	Face up	1	2412		
			6	2437	0.055	0.030
			11	2462		
		Face down	1	2412		
			6	2437	**0.073**	0.041
			11	2462		
		w/ headset	6	2437	0.072	0.040

Note: KDB 248227 - SAR is not required for 802.11g/HT20 channels when the maximum average output power is less than 1/4 dB higher than that measured on the corresponding 802.11b channels

11. WORST-CASE SAR TEST PLOTS

Worst-case HEAD SAR Plot for Part 22

Date/Time: 3/30/2010 2:42:12 PM

Test Laboratory: Compliance Certification Services

UMTS band V_Left Hand Side

DUT: Apple; Type: N/A; Serial: N/A

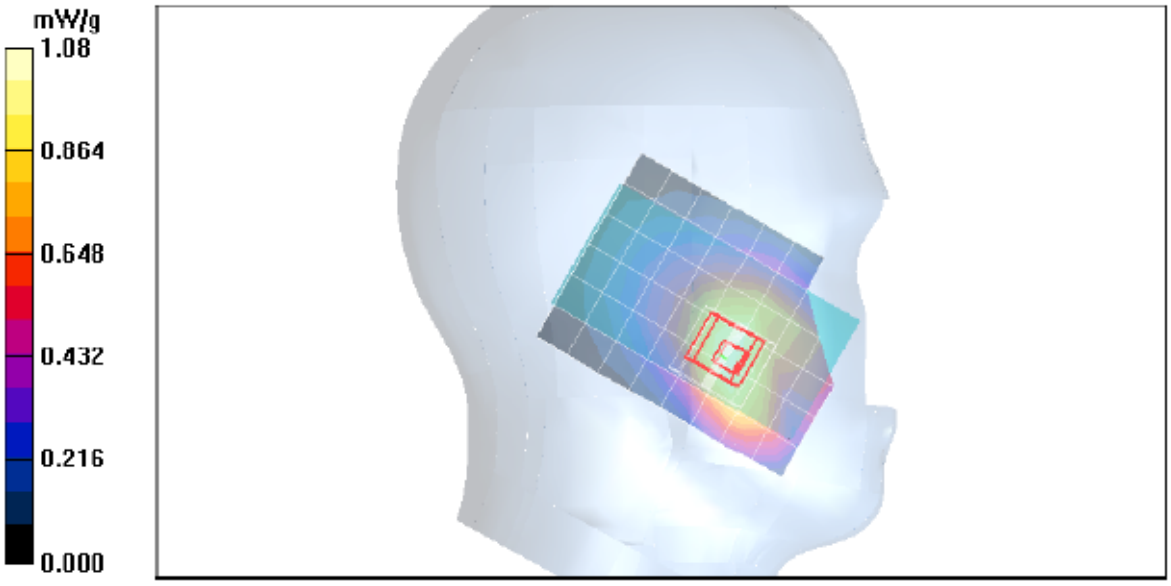
Communication System: UMTS850; Frequency: 836.6 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.884 mho/m; ε_r = 43.6; ρ = 1000 kg/m^3
Phantom section: Left Section

Room Ambient Temperature: 25.0 deg. C; Liquid Temperature: 24.0 deg. C

DASY4 Configuration:
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV3 - SN3531; ConvF(10.13, 10.13, 10.13); Calibrated: 2/23/2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn500; Calibrated: 9/15/2009
- Phantom: SAM 2 (Twin); Type: SAM 2; Serial: 1050
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Touch_M-ch/Area Scan (7x9x1): Measurement grid: dx=15mm, dy=15mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.08 mW/g

Touch_M-ch/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 12.0 V/m; Power Drift = 0.035 dB
Peak SAR (extrapolated) = 1.27 W/kg
SAR(1 g) = 1 mW/g; SAR(10 g) = 0.729 mW/g
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.11 mW/g



Worst-case HEAD SAR Plot for Part 24

Date/Time: 3/29/2010 1:09:50 PM

Test Laboratory: Compliance Certification Services

UMTS band II_Left Hand Side

DUT: Apple; Type: N/A; Serial: N/A

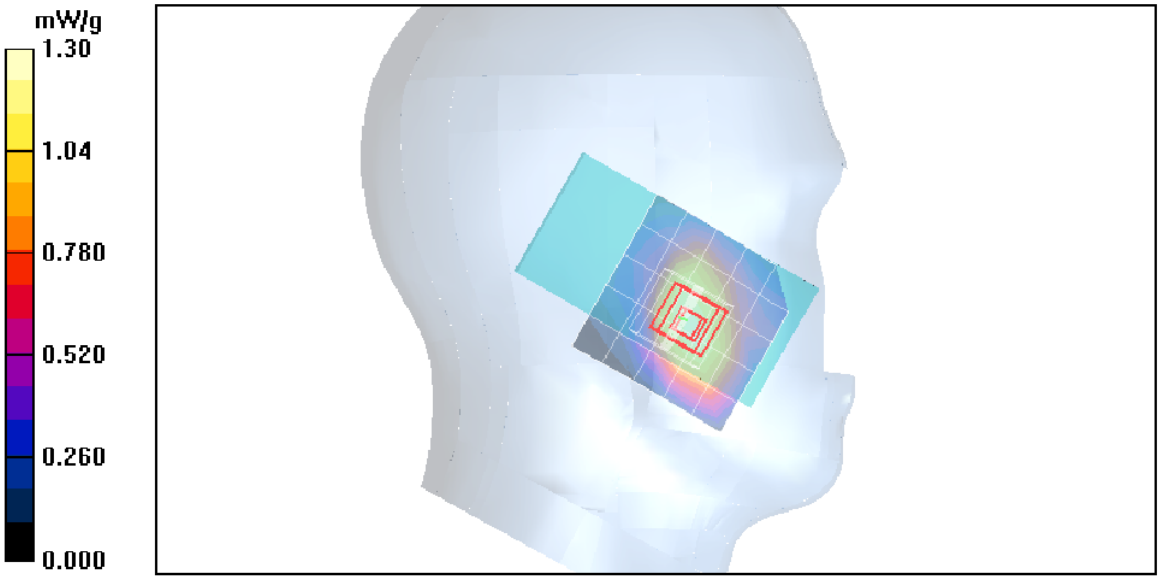
Communication System: PCS 1900; Frequency: 1907.6 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 1907.6 MHz; σ = 1.36 mho/m; ε_r = 39.1; ρ = 1000 kg/m^3
Phantom section: Left Section

Room Ambient Temperature: 25.0 deg. C; Liquid Temperature: 24.0 deg. C

DASY4 Configuration:
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV3 - SN3531; ConvF(8.64, 8.64, 8.64); Calibrated: 2/23/2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn500; Calibrated: 9/15/2009
- Phantom: SAM 2 (Twin); Type: SAM 2; Serial: 1050
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Touch_H-ch/Area Scan (6x6x1): Measurement grid: dx=15mm, dy=15mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.30 mW/g

Touch_H-ch/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 10.1 V/m; Power Drift = 0.024 dB
Peak SAR (extrapolated) = 1.65 W/kg
SAR(1 g) = 1.17 mW/g; SAR(10 g) = 0.756 mW/g
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.35 mW/g



Worst-case HEAD SAR Plot for Part 15 C

Date/Time: 4/2/2010 11:46:49 PM

Test Laboratory: Compliance Certification Services

MURATA_WiFi_Left Hand Side

DUT: Apple; Type: N/A; Serial: N/A

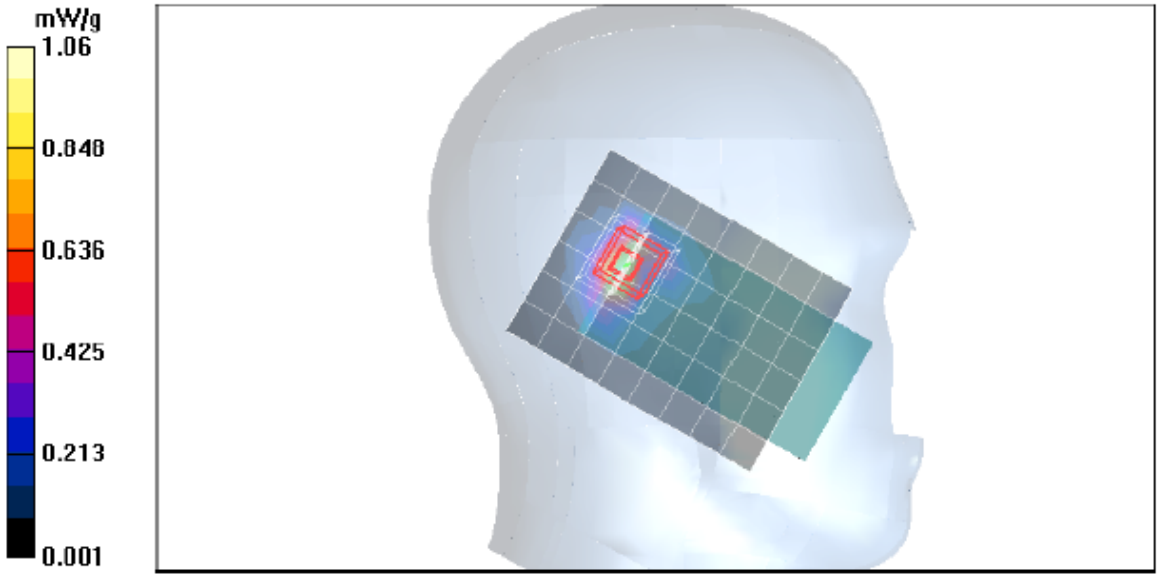
Communication System: 802.11b; Frequency: 2462 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2462 MHz; σ = 1.86 mho/m; ε_r = 38.8; ρ = 1000 kg/m^3
Phantom section: Left Section

Room Ambient Temperature: 25.0 deg. C; Liquid Temperature: 24.0 deg. C

DASY4 Configuration:
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV3 - SN3531; ConvF(7.6, 7.6, 7.6); Calibrated: 2/23/2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn500; Calibrated: 9/15/2009
- Phantom: SAM 2 (Twin); Type: SAM 2; Serial: 1050
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Tilt_H-ch/Area Scan (7x9x1): Measurement grid: dx=15mm, dy=15mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.06 mW/g

Tilt_H-ch/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 13.2 V/m; Power Drift = -0.203 dB
Peak SAR (extrapolated) = 1.89 W/kg
SAR(1 g) = 0.871 mW/g; SAR(10 g) = 0.385 mW/g
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.17 mW/g



Worst-case BODY SAR plot for Part 22

Date/Time: 3/31/2010 12:38:15 PM

Test Laboratory: Compliance Certification Services

GPRS850_Body

DUT: Apple; Type: NA; Serial: NA

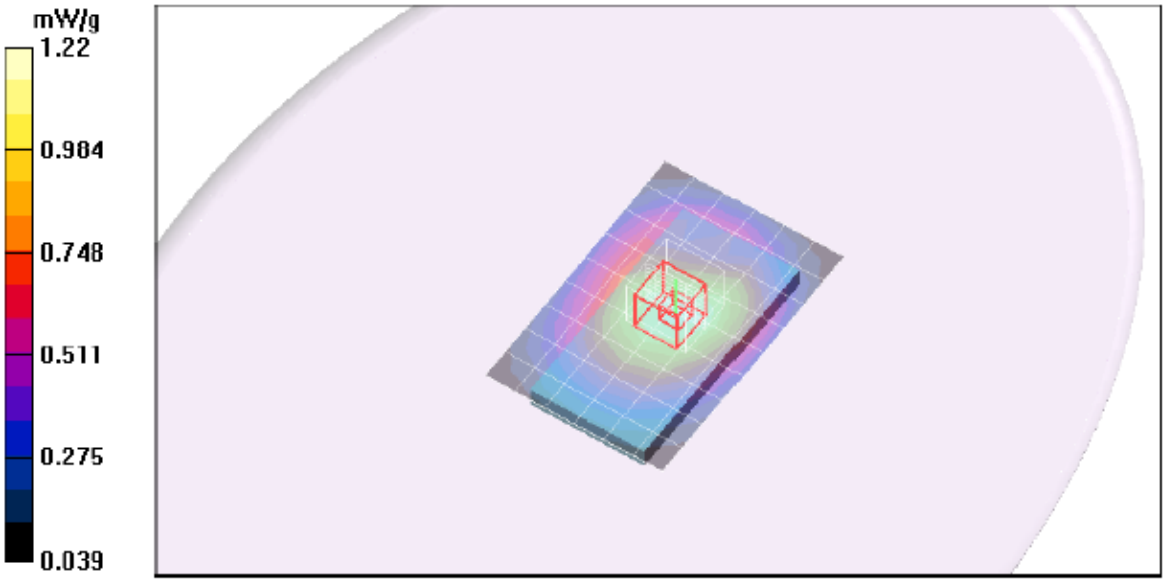
Communication System: GSM850; Frequency: 848.8 MHz;Duty Cycle: 1:4
Medium parameters used (interpolated): f = 848.8 MHz; σ = 1.01 mho/m; ε_r = 55; ρ = 1000 kg/m^3
Phantom section: Flat Section

Room Ambient Temperature: 24.0 deg. C; Liquid Temperature: 23.0 deg. C

DASY4 Configuration:
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV3 - SN3531; ConvF(10.18, 10.18, 10.18); Calibrated: 2/23/2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn500; Calibrated: 9/15/2009
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1003
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Face down_GPRS 2 slots H-ch/Area Scan (7x10x1): Measurement grid: dx=15mm, dy=15mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.22 mW/g

Face down_GPRS 2 slots H-ch/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 15.9 V/m; Power Drift = -0.028 dB
Peak SAR (extrapolated) = 1.47 W/kg
SAR(1 g) = 1.11 mW/g; SAR(10 g) = 0.809 mW/g
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.24 mW/g



Worst-case BODY SAR plot for Part 24

Date/Time: 3/29/2010 7:38:26 PM

Test Laboratory: Compliance Certification Services

UMTS band II_Body

DUT: Apple; Type: NA; Serial: NA

Communication System: PCS 1900; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1880 MHz; σ = 1.48 mho/m; ε_r = 53.4; ρ = 1000 kg/m^3
Phantom section: Flat Section

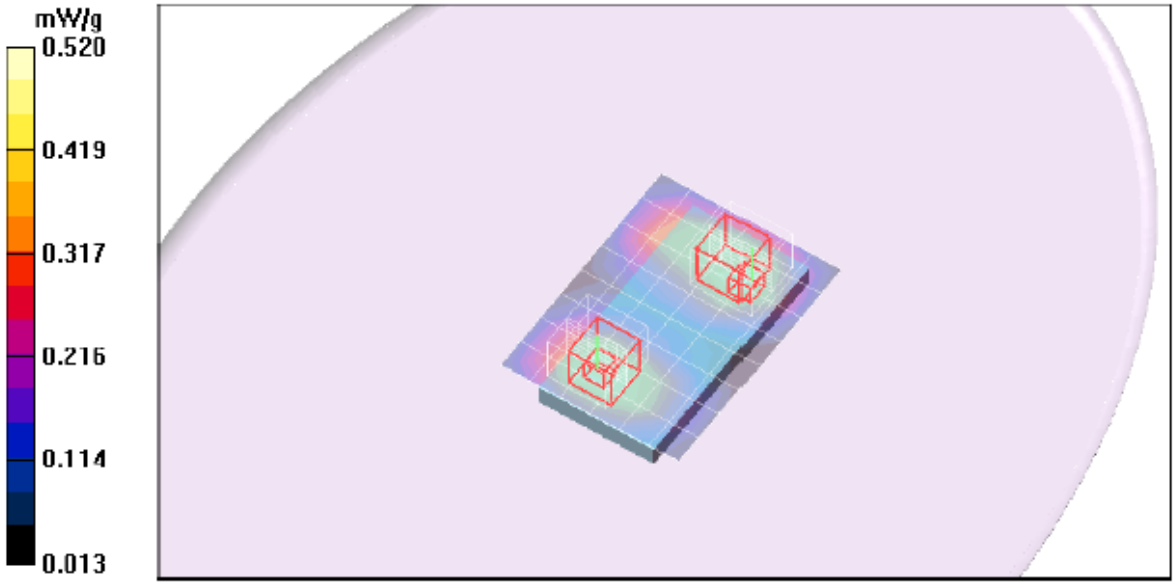
Room Ambient Temperature: 25.0 deg. C; Liquid Temperature: 24.0 deg. C

DASY4 Configuration:
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV3 - SN3531; ConvF(8.04, 8.04, 8.04); Calibrated: 2/23/2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn500; Calibrated: 9/15/2009
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1003
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Face down_M-ch/Area Scan (7x9x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.476 mW/g

Face down_M-ch/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 14.9 V/m; Power Drift = 0.049 dB
Peak SAR (extrapolated) = 0.634 W/kg
SAR(1 g) = 0.433 mW/g; SAR(10 g) = 0.283 mW/g
Maximum value of SAR (measured) = 0.503 mW/g

Face down_M-ch/Zoom Scan 2 (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 14.9 V/m; Power Drift = 0.049 dB
Peak SAR (extrapolated) = 0.630 W/kg
SAR(1 g) = 0.401 mW/g; SAR(10 g) = 0.257 mW/g
Maximum value of SAR (measured) = 0.474 mW/g



Worst-case BODY SAR plot for Part 15 C

Date/Time: 4/2/2010 9:51:58 PM

Test Laboratory: Compliance Certification Services

MURATA_WiFi_Body

DUT: Apple; Type: NA; Serial: NA

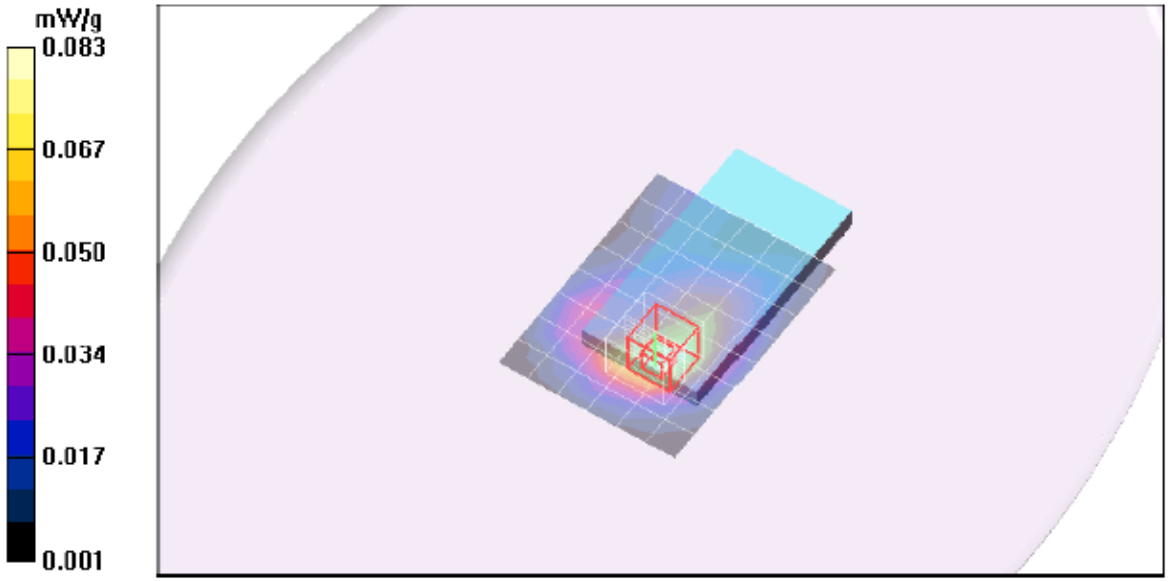
Communication System: 802.11b; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2437 MHz; σ = 1.93 mho/m; ε_r = 52.9; ρ = 1000 kg/m^3
Phantom section: Flat Section

Room Ambient Temperature: 25.0 deg. C; Liquid Temperature: 24.0 deg. C

DASY4 Configuration:
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV3 - SN3531; ConvF(7.58, 7.58, 7.58); Calibrated: 2/23/2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn500; Calibrated: 9/15/2009
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1003
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Face down_M-ch/Area Scan (7x9x1): Measurement grid: dx=15mm, dy=15mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.083 mW/g

Face down_M-ch/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 5.74 V/m; Power Drift = -0.140 dB
Peak SAR (extrapolated) = 0.131 W/kg
SAR(1 g) = 0.073 mW/g; SAR(10 g) = 0.041 mW/g
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.090 mW/g



12. KDB 648474 SIMULTANEOUS TRANSMISSION CONSIDERATION

SUMMARY OF SAR EVALUATION FOR A CELL PHONE WITH MULTIPLE TRANSMITTERS

Individual Transmitter	Stand-alone SAR
3G	Yes
WiFi	Yes
Bluetooth	Not required (average output is < P_{Ref} / 12mW)

SIMULTANEOUS TRANSMISSION

- 3G can transmit simultaneously with WiFi
- 3G can transmit simultaneously with Bluetooth
- WiFi can not transmit simultaneously with Bluetooth

Highest SAR value and the sum of the 1-g SAR for 3G & WiFi

Tes position	Highest 1-g SAR (W/kg)			∑1-g SAR (W/kg)
	3G		WiFi	
Head (LHS Touch)	UMTS850	1.00	0.651	**1.651**
	UMTS1900	1.17		**1.821**
Body (LCD down)	GPRS850 2 slots	1.11	0.073	1.183
	UMTS1900	0.433		0.433

Antenna Pair SAR to Peak Location Separation Ratio if ∑ 1-g SAR > 1.6 W/kg

∑ 1-g SAR (W/kg)	Separation distance (cm) (3G-to-WiFi antenna)	Antenna Pair SAR to Peak Location Separation Ratio
1.651	8.7	0.19
1.821	8.7	0.21

Highest SAR value and the sum of the 1-g SAR for WiFi & 3G

Tes position	Highest 1-g SAR (W/kg)			∑1-g SAR (W/kg)
	WiFi	3G		
Head (LHS Tilt)	0.871	UMTS850	0.433	1.304
		UMTS1900	0.411	1.282
Body (LCD down)	0.073	GPRS850 2 slots	1.110	1.183
		UMTS1900	0.433	0.506

CONCLUSION:

Simultaneous transmission	Simultaneous SAR
3G & Bluetooth	No (Stand-alone SAR not required for Bluetooth)
WiFi & Bluetooth	No (Stand-alone SAR not required for Bluetooth)
3G & WiFi	No (see note below)

Note: SAR not required:

- o when the sum of the 1-g SAR is < 1.6 W/kg for 3G and WiFi
- o when SAR to peak location separation ration of simultaneous transmitting antenna pair is < 0.3

13. ATTACHMENTS

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